

FORM PTO-1390 (REV 12-29-99)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER 204, 509
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		U.S. APPLICATION NO. (If known, see 37 CFR 1.5) 09/554032		
INTERNATIONAL APPLICATION NO. PCT/SI98/00008	INTERNATIONAL FILING DATE March 30, 1998	PRIORITY DATE CLAIMED Nov. 4, 1997 and March 27, 1998		
TITLE OF INVENTION A DRYING DEVICE				
APPLICANT(S) FOR DO/EO/US Joze PLESTENJAK				
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:				
<ol style="list-style-type: none"> <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371. <input checked="" type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1). <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date. <input type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2)) <ol style="list-style-type: none"> <input type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau). <input type="checkbox"/> has been transmitted by the International Bureau. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US). <input type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)). <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)) <ol style="list-style-type: none"> <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau). <input type="checkbox"/> have been transmitted by the International Bureau. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. <input type="checkbox"/> have not been made and will not be made. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4))—<u>unsigned</u> <input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)). 				
Items 11. to 16. below concern document(s) or information included:				
<ol style="list-style-type: none"> <input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included. <input checked="" type="checkbox"/> A FIRST preliminary amendment. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment. <input type="checkbox"/> A substitute specification. <input type="checkbox"/> A change of power of attorney and/or address letter. <input checked="" type="checkbox"/> Other items or information: PCT Request; PCT Appln. as published; with International Search Report and drawings; form PCT/IB/332; form PCT/IB/308; PCT International Preliminary Examination Report. 				

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17. <input checked="" type="checkbox"/> The following fees are submitted: BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) : Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$970.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$840.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$690.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$670.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) \$96.00		CALCULATIONS PTO USE ONLY \$ 840.00	
ENTER APPROPRIATE BASIC FEE AMOUNT =		\$ 840.00	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).		\$	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE
Total claims	26 - 20 =	6	X \$18.00 \$ 108.00
Independent claims	1 - 3 =		X \$78.00 \$
MULTIPLE DEPENDENT CLAIM(S) (if applicable)		+ \$260.00 \$	
TOTAL OF ABOVE CALCULATIONS =		\$ 948.00	
Reduction of 1/2 for filing by small entity, if applicable. A Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28).		\$	
SUBTOTAL =		\$ 948.00	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).		\$	
TOTAL NATIONAL FEE =		\$ 948.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property		\$	
TOTAL FEES ENCLOSED =		\$ 948.00	
		Amount to be refunded: \$	
		charged: \$	
<p>a. <input checked="" type="checkbox"/> A check in the amount of \$ 948.00 to cover the above fees is enclosed.</p> <p>b. <input type="checkbox"/> Please charge my Deposit Account No. _____ in the amount of \$ to cover the above fees. A duplicate copy of this sheet is enclosed.</p> <p>c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 01-00035. A duplicate copy of this sheet is enclosed.</p>			
<p>NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.</p>			
SEND ALL CORRESPONDENCE TO:		May 4, 2000	
ABELMAN FRAYNE & SCHWAB Attorneys at Law 150 East 42nd Street New York, NY 10017 (212) 949-9022		 Howard R. Jaeger SIGNATURE: Howard R. Jaeger NAME: 31,376 REGISTRATION NUMBER:	

422 Rec'd PCT/PTO 04 MAY 2000

U.S. APPLICATION NO. (if known see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO. PCT/ SI98/00008	ATTORNEY'S DOCKET NUMBER 204,509																				
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097554032
422 Rec'd PCT/PTO 34 MAY 2000

STATEMENT OF FILING BY EXPRESS MAIL 37 C.F.R. §1.10

This correspondence is being deposited with the United States Postal Service on May 4, 2000 in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number EK 051386257 US addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

PATENT
204,509

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION OF: Joze PLESTENJAK

APPLICATION NO.:NEW US PAT APPLN -

Not yet assigned

FILED: Herewith

FOR: DRYING DEVICE

GROUP ART UNIT: Not yet assigned

EXAMINER: Not yet assigned

Assistant Commissioner for Patents
Washington, DC 20231

Dear Sir:

PRELIMINARY AMENDMENT

Applicant respectfully requests entry of the following Preliminary
Amendment and accompanying Remarks into the file of the subject case, filed on
even date herewith, prior to commencement of examination on the merits.

IN THE SPECIFICATION

Amend the title of the application from "A drying device" to --DRYING DEVICE--.

Page 1: Between title and first line of text, insert --Field of the Invention--; and

Between lines 3 and 4, insert --Background of the Invention--.

Page 5: Between lines 5 and 6, insert --Summary of the Invention--.

Page 7: Between lines 5 and 6, insert -- Brief Description of the Drawings--; and

Between lines 21 and 22, insert --Detailed Description of Preferred Embodiments of the Invention--.

IN THE CLAIMS

Amend the claims as follows:

Cancel, without prejudice, claims 1-20, and replace with new set of claims 21-46, as follows:

--21. (New) A drying device for removing moisture from moisture-containing

materials placed inside the drying device, the drying device comprising:

- a) a kiln compartment (1), having a plurality of side walls (11,12,13,14), a top wall (100), and a bottom wall (101), that define a kiln volume (6), for holding material to be dried, the kiln compartment (1) further having at least one loading door (131) through which the material to be dried is placed into the kiln compartment (1);
 - b) at least one system vent (111), movably positioned in at least one side wall (11,12,13,14), and communicating between the kiln compartment (1) and the exterior of the drying device;
 - c) a heat condensation device (2), including a housing (20), containing a condensation unit (21), a heating unit (22), and at least one ventilator (25), positioned in at least one side wall (11,12,13,14) opposite to and different from the side wall (11,12,13,14) in which the at least one system vent (111) is positioned;
 - d) an air deflector (3), positioned in an upper zone of the kiln volume (6) in the kiln compartment (1);

e) a tunnel-shaped air shaft (1000), extending horizontally along the kiln compartment (1) proximate to the top wall (100), and forming an air passage (30) between the air deflector (3) and the system vent (111); and

f) a ventilation unit (40), positioned in the tunnel-shaped air shaft (1000), for drawing air into the tunnel-shaped air shaft (1000);

such that a volume of dry air is circulated in the kiln compartment (1) by a plurality of ventilators to absorb moisture from the material to be dried.

22. (New) The drying device according to claim 21, further comprising at least two aerating and exhausting shafts (121,122), and a micro climate vent (1211), which is attached to a side wall (12) of kiln compartment (1), such that both aerating and exhausting shafts (121,122) are connected to the micro climate vent (1211), proximate to the air deflector (3), and such that the aerating and exhaustion shaft (121) is positioned such that it communicates between the kiln compartment (1) proximate to the top (100) thereof and the exterior of the drying device, and such that the aerating and exhaustion shaft (122) is positioned such that it communicates between the kiln compartment (1) proximate to the bottom (101) thereof and the exterior of the drying device,

23. (New) The drying device according to claim 21, further comprising at least two aerating and exhausting shafts (121,122), and at least two micro climate vents (1211,1221), which are attached to a side wall (12) of the kiln

compartment (1), such that both aerating and exhausting shafts (121,122) are connected to micro climate vent (1211) arranged adjacent to the wall (12) of the kiln compartment (1).

24. (New) The drying device according to claim 21, further comprising at least one additional ventilation unit (7), including ventilator (71), positioned in the kiln volume (6) on an adjustable support (72), for enabling angular dispersion of air flow, and such that the ventilation unit (7) is in an off mode when placed parallel to a side wall and is in an on mode when placed nonparallel to a side wall.

25. (New) The drying device according to claim 22, further comprising at least one additional ventilation unit (7), including ventilator (71), positioned in the kiln volume (6) on an adjustable support (72), for enabling angular dispersion of air flow, and such that the ventilation unit (7) is in an off mode when placed parallel to a side wall and is in an on mode when placed nonparallel to a side wall.

26. (New) The drying device according to claim 23, further comprising at least one additional ventilation unit (7), including ventilator (71), positioned in the kiln volume (6) on an adjustable support (72), for enabling angular dispersion of air flow, and such that the ventilation unit (7) is in an off mode when placed

parallel to a side wall and is in an on mode when placed nonparallel to a side wall.

27. (New) The drying device according to claim 21, wherein the system vent (111) is positioned on the side wall (11) of the kiln compartment (1), adjacent to the door (131) of the kiln compartment (1), the system vent being capable of alternatively assuming a closed position and an open position, such that when the system vent (111) is in the in the closed position, there is enabled an internal circulation of air flow from the tunnel-shaped air shaft (1000) in the area between the top (100) of the kiln compartment (1) and the air deflector (3), passing through the air passage (30) between the air deflector (3) and the wall adjacent to the door (131) in the kiln volume (6) in a direction towards the self adjustable vent (31) and under the air deflector (3) towards the heat condensation unit (2), since in the case when the system vent (111) is opened the air flow is passing from the tunnel shaped air shaft (1000) through at least two gaps formed by opening the system vent (111) the air is blown out of kiln compartment (1) in open space on the upper side trough at least one gap and simultaneously the fresh air is sucked from outside directly into the kiln volume (6) through at least one lower gap.

28. (New) The drying device according to claim 21, wherein the ventilation unit (40) further comprising a plurality of ventilators (41,42,43,44), which are positioned in the tunnel-shaped air shaft (1000) between the air deflector (3)

and the top wall (100) of the kiln compartment (1), such that at least one of the ventilators (41,42,43,44) is equipped with at least one corresponding heating unit (430, 440), provided for heating the air in the tunnel-shaped air shaft (1000).

29. (New) The drying device according to claim 28, wherein there are four ventilators (41,42,43,44), arranged in two pairs of two, arranged side-by-side, such that a first pair of ventilators (41,42) is positioned in the tunnel-shaped air shaft (1000) towards one end of the kiln compartment (1), and a second pair of ventilators (43,44) is positioned in the tunnel-shaped air shaft (1000) towards an opposite end of the kiln compartment (1), and further such that two of the ventilators (43,44) are provided with corresponding heating units (430,440).

30. (New) The drying device according to claim 21, further comprising a plurality of carriage stacking units (5) for containing the material to be dried, each carriage stacking unit (5) having a plurality of vertical elements (51), spaced apart from one another, and a plurality of horizontal elements (52), spaced apart from one another.

31. (New) The drying device according to claim 30, wherein at least one of the carriage stacking units (5) is equipped with wheels (50).

32. (New) The drying device according to claim 30, wherein the carriage stacking units (5) are stackable one on top of another.

33. (New) The drying device according to claim 31, wherein the carriage stacking units (5) are stackable one on top of another.

34. (New) The drying device according to claim 21, further comprising a condensate outlet pipe (201), mounted in the housing (20) of the heat condensation device (2), for outlet of condensate formed by the cooling of moist air in the condensation unit (21), a compressor (23), and a throttling valve (24), such that the condensation unit (21), the heating unit (22), the compressor (23) and the throttling valve (24), form a closed circuit through which a thermally conductive fluid is circulated.

35. (New) The drying device according to claim 21, wherein the kiln compartment (1) is constructed to have standardized dimensions of a container for international container transports.

36. (New) The drying device according to claim 21, wherein the vent (31) of the air deflector (3) is self-adjusting.

37. (New) The drying device according to claim 21, further comprising a radiation device (8), placed in an interior of the kiln compartment (1), proximate to the venting and exhausting shafts (121,122).

38. (New) The drying device according to claim 37, wherein the radiation device (8) is an emitter of ultra-violet rays.

39. (New) The drying device according to claim 21, further comprising at least two magnets (9), which are positioned in the kiln compartment (1).

40. (New) The drying device according to claim 39, wherein the magnets (9) are permanent-magnets.

41. (New) The drying device according to claim 40, wherein the at least two permanent magnets (9) in the interior of the kiln compartment (1), are positioned adjacent to the exhausting and aerating shafts (121,122) and the air deflector (3), and provide a bipolar magnetic field.

42. (New) The drying device according to claim 29, wherein the distance between adjacent vertical distant elements (51), viewed in a horizontal direction, is shorter than the distance between adjacent side vertical supports (52).

43. (New) The drying device according to claim 26, wherein the vertical distance elements (51) and the horizontal distance elements (52) of the stacking unit (5) are spaced apart from one another a sufficient distance and layers of material to be dried placed inside the stacking unit (5) are spaced apart from one another a sufficient distance to form an air gap between distance elements (51,52) and

between layers of the material to be dried, to enable circulating drying air to flow between the distance elements and between layers of material to be dried.

44. (New) The drying device according to claim 42, wherein the vertical distance elements (51) and the horizontal distance elements (52) of the stacking unit (5) are spaced apart from one another a sufficient distance and layers of material to be dried placed inside the stacking unit (5) are spaced apart from one another a sufficient distance to form an air gap between distance elements (51,52) and between layers of the material to be dried, to enable circulating drying air to flow between the distance elements and between layers of material to be dried.

45. (New) The drying device according to claim 21, wherein the microclimate vent (1211) is actuated when there is an increase in the moisture content of the air at the top (100) of the kiln compartment (1), and such that the vent (1211) operatively cooperates with air shafts (121,122), such that it is connected with the kiln volume (6) by the air shaft (122), through which air is exhausted; and such that it is connected with air shaft (121) whereby when a pressure differential exists, fresh outside air is taken-in to the area (10'), and further such that when the microclimate vent (1211) is inactivated, the drying process is isolated from external atmospheric air and internal air circulation is generated in the kiln compartment (1).

46. (New) The drying device according to claim 21, wherein the microclimate vent (1211) is actuated when there is an increase in the moisture content of the air at the top (100) of the kiln compartment (1), and such that the vent (1211) operatively cooperates with air shafts (121,122), such that it is connected with the kiln volume (6) by the air shaft (122), through which air is exhausted; and such that it is connected with air shaft (121) whereby when a pressure differential exists, fresh outside air is taken-in to the area (10'), and further such that when the microclimate vent (1211) is inactivated, the drying process is isolated from external atmospheric air and internal air circulation is generated in the kiln compartment (1).--

REMARKS

Claims 1-20 of the original PCT application have been canceled, without prejudice from the present US application. They are to be replaced by new claims 21-46, submitted herewith. Claims 21-46 are drawn to the same subject matter as original claims 1-20, but have been rewritten in a more standard form according to US practice. Original multiple dependent claims 3,8,19, and 20 have been rewritten as separate dependent claims.

New claims 21-46 represent 26 claims, including 1 independent claim and 25 dependent claims. This represents an additional 6 claims over and above the 20 claims paid for with the basic application filing fee. Although applicant has Small Entity status, a Verified Statement of same has not yet been filed. Accordingly, applicant should presently be charged for the additional claims at the regular entity rate. The additional claims fee is calculated on the accompanying application transmittal sheet. The original and a copy thereof are transmitted herewith. Authorization to charge the basic filing fee, the additional claims fees, and any additional fees that may be due with the filing of this application to Deposit Account 01-0035 is made thereon.

Dated: May 4, 2000

Respectfully submitted,



Howard R. Jaeger, Esq.
Reg. No. 31,376
Attorney for Applicant

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A drying device

The invention relates to a drying device, particularly for drying wood and semi-products of wood like veneer or sawn wood as well as other products.

A groving tree as a woody perennial plant contains relatively huge amounts of moisture content wvarying from one kind to another which stays in the tree after being cut down. As it is known wood contains capillaries in cells that contain free liquid and absorbed molecules of water called moisture content which must be lowered to a certain level to satisfy needs of industrial use. For that reason, wood has to be properly treated, namely dried to a certain value of acceptable end moisture distribution content in a way to prevent occurring of all kinds of drying defects. The drying process is a mayor factor in economic terms.

Wood could be dried under natural circumstances in the open – air drying if wood climate relation conditions are good enough and consequently generating acceptable quality of dried sawn wood. It has to be considered that air drying of wood is a long term process which could extend into years. When finally wood is dried it needs proper storage conditions that include natural circulation of dry warm air and other terms of planning. It has to be considered that absorbed water in the wood can emerge and evaporate with the help of surrounding air flow only in case if the surface is not covered by rain fall water, snow or other substances. Influencing on air drying technology

by restacking with ventilation abilities do help in minor values with the constant risk of wood being attacked by mould, microorganisms, fungi, insects including uneven drying that can worsen quality of wood expressed with other terms concerning its quality. There is always a potential problem of shape deformations that can emerge because of natural air - drying unpredictable situations that cannot be prevented by any preventive process control technology or monitoring of any kind. Moisture distribution content in wood is by using technology of drying by air after a certain period of time depending on climate conditions what means that time variation is present in planning emerging other problems usually leading to higher costs, too much rejections of quality assurance and alike. On the other hand there are also some other effects of such a technology like low energy consumption, huge drying areas, storage departments, safety provisions. There were some experiments executed to shorten air - drying process by engaging axial fans, but there are too many other parameters like relative humidity and others on which axial fans cannot influence.

With the intention to reduce drying time in the aspect of cost, quality and time were developed drying devices of different kinds, which can be distinguished by a technological approach in a following manner: The first type is a compartment type and tunnel kiln type. Both known types of drying devices can be characterized as stationary types. By the first type of drying devices the wood is placed in available compartment which has the ability of generating different physical conditions like: temperature, humidity, air flow capacity and alike, with the intention of proceeding of the drying process. By the second type of drying devices the wood is transported with the help of horizontal transport unit through the drying device where it is sequentially processed under different physical conditions, mainly for the purposes of gradually executing the drying process. Compartment type drying devices are cheaper, but with lower production rate in comparison with the tunnel kiln type drying devices, where investment costs are relatively high.

3

The already known types of drying devices have certain disadvantages which will be explained in details as follows including the decisions of great investment cost and setting up difficulties in aspect of economy factors.

The technology processes used nowadays by drying the wood are performed either by low temperatures between 15 and 45°C or by medium temperatures between 45 and 90°C or also by high temperatures between 90 and 130°C with the possibility of achieving above specified temperatures e.g. by means dielectrical, convectional, conduction or radiation principles.

By certain types of drying devices the wood is put into compartment by means of suitable transport carriages. With the ventilators placed on the ceiling or rarely on other locations an air flow is created which is in some cases blown transversely, yet by others the air flow is lead horizontaly and transversely and still in other versions the air is lead longitudinaly.

By all these known drying devices the transport units are constructed in a manner and with such dimensions that enable loading as great quantities of wood as possible in the kiln volume. The wood is stacked by along ventilation in a way that air flow is possible at least in one horizontal plane. A certain compromise has to be achieved with the consideration of dimensions of the air gap that is neccessary for air flow and the amount of wood in the kiln. The hot air is then blown through the air gaps in order to fasten up the intensity of drying. When the hot air gets in contact with the wood containing high moisture level it absorbs it to its highest possible value, what causes enabling of absorption of moisture, that is still present deeper in the pile. Consequently that means that ventilators create enough strong air flow yet with the highest moisture level possible what means only a lot of waste of energy. Because of high moisture level in the air it is very likely that it condenses on cooler places such as walls and other equipment causing damage. The condensed liquid that stays in the kiln volume efects harmfull on it as well as to the drying process.

As noted in the patent application EP 0 170 648 A1 which is intended to execute one of the latest drying technologies the compartment has warm-insulated walls. The sawn wood is being stacked by longitudinally ventilation in the kiln volume. In the drying device there is installed a ventilator which enables air flow passing through a heating register then continuing on trough stacked wood to the cooling register where the air flow is led in a way of repeating the same loop. In the area of heating register the air is warmed up then as passing trough the stacked wood it picks up moisture which is then released by passing trough the colling register to the warming register. Such a combination is likely to create condensate if fresh sawn wood is processed but is quite suitable for wood with low moisture volume - the final touch - before being used up by industry.

If desired that by means of saturated air generated by drying process of stacked wood as highest as possible quantity of moisture should be departed from compartment, the air must be heated. The disposal of great amounts of saturated air is combined with great looses of heat used before as heating air. Energy yield by using this technology of drying wood is low.

Except of the above mentioned drying technologies also a vacuum drying technology is described in the PCT/DK87/00012 and WO 87/04779, where e.g. intensivity of drying process could be monitored in order to avoid drying defects. The devices with applied vacuum technology are very sensitive in maintaining proper vacuum conditions and are more suitable for drying processes for wood containing lower values of moisture what means that other drying technology for eliminating the majority of moisture has to be used theretofore.

By all these known solutions it can be summarized that all of them have certain imperfections, e.g. relatively low energy yield being unacceptable for

global economy, or high requirements in respect of the space consumption, highly dependence on power sources, a high probability of drying defects, very small or no adaptable abilities and are moreover built as a stationary type with drying capacities that dictate the amounts of drying wood and technology.

According to the invention, the drying unit is provided by an aerated housing, the inner area of which is connected by the circumferential area by means of exhausting conduits and aerating conduits. Thus, in accordance with the principals of the invention, the new drying device is created on the basis of many ventilation air systems containing different type of airflow intake as well as disposal air possibilities that are fixed to the drying device. Such a device is equipped by a heat condensation device containing a heating unit, a condensation unit and a ventilator. The drying device has a drying kiln in which with the help of transporting carriage is placed wood intended to be dried. The drying process is executed in the drying kiln by enforced circulating air. At least one wall of the kiln compartment is equipped by suitable air shafts for aerating or exhausting functions as an integrated unit of the drying device including the system vent which has the function of air pre-orientation in any time required during the drying process in coinsistence with air deflector placed above the loading volume integrated in the kiln compartment by the heat condensation unit, which extends from the opposite side of the drying compartment and ends at the bottom of the kiln compartment. The air deflector by the heat condensation device has mounted at least one vent, which could be self-adjustable and an integrated unit consisting of a partition wall and the top of kiln volume, which in combination with the top of the kiln compartment presents a tunnel-shaped air shaft in which the ventilation system is placed. The whole above mentioned section is called an air deflector. The already mentioned air shafts start on the micro climate vent mounted on the top of the kiln compartment, then they are lead mainly along the side wall and are ended within the space of the kiln volume.

WO 99/23430

PCT/SI98/00008

6

In the kiln volume there is arranged at least one ventilation unit with the ability of angular adjustment with the possibility of positioning it either in the on- or in the off-state function. With the microclimate went in closed position connected with the air shafts, ranging from the top of the kiln compartment ending in the kiln volume are generated conditions for creating an internal air circulation, but in open position the internal circulation gets in contact again with the help of the shafts with external atmosphere with parallel air flow of moistured air blown out of the kiln volume in the atmosphere and sucked in fresh dry air in the tunnel shaped air shaft due to the pressure difference. In the tunnel-shaped air shaft is recommended an installation of heating elements.

In accordance with the invention is the unit for stacking wood or other products intended for drying also equipped with accessories that enable vertical and horizontal stacking and longitudinal ventilation. The accessories also enable vertical positioning of dominant surfaces of the drying wood. The distance holders that enable stacking of wood are placed vertically in relationship to each other and are shorter than the vertical supports of the unit. The said units can be mounted one on each other. The bottom carriage can be equipped by transport wheels. In accordance with the present solution in the kiln compartment space close to the micro climate vent is placed an UV-emitter meant for emitting ultra-violet rays to the moisture contained in the air with the intention of eliminating the possibility of development of culers like mould, fungi and other microorganismus.

In accordance with the principals of the invention is the new drying device equipped with magnets assembled in the kiln compartment in bipolar arrangement what means that magnetization treatment influences on all the processes – chemical, physical and biological.

According to the invention, the drying device also comprises a heating condensation device with a ventilator assembled in the opening of partition

wall. The heating condensation device is designed in a way of irregular medium flow linking to increase condensation effect as well as heating emission.

Now, the invention will be described in more detail on the basis of an embodiment as shown in the accompanied drawings, where

Fig. 1 is a longitudinal cross-section of the drying device in a vertical plane;

Fig. 2 is a transversal cross-section of the device in the vertical plane;

Fig. 3 is a longitudinal cross-section of the device in a horizontal plane;

Fig. 4 is a longitudinal cross-section of the device in the vertical plane,

however during its operation mode comprising combination of dehumidification drying and convection drying with the wood stacked to enable ventilation in the longitudinal direction;

Fig. 5 is a transversal cross-section of the device according to Fig. 5 in its vertical plane;

Fig. 6 is a longitudinal cross-section of the device according to Fig. 1 - 3, however during its further operation mode suitable for accelerated process of natural air drying, again with the stacked wood;

Fig. 7 is a transversal cross-section of the drying device according to Fig. 5;

Fig. 8 shows a condensation unit of the device according to the invention; and

Fig. 9 shows a unit for stacking wood also comprised by the device according to the invention.

A drying device shown in Fig. 1 - 3 is in generally designed for drying wood and other materials with the kiln compartment 1 constructed as to fulfill standards and other requirements known in the field of transport where standard containers are used for all known transport possibilities. The proportions of the kiln compartment 1 have certain advantages comparing with all till now known drying devices as well as certain limitations, which may be however overcome by the solution according to the invention. In such a

manner it is possible to exploit the drying device by the user either e.g. as a stationary or a mobile device with extremely quick and simple installation to appropriate location.

At least one of the side walls 11, 12, 13, 14 of the kiln compartment 1, namely in this case the longitudinal wall 13, is equipped by a suitable door 131, allowing e.g. to enter the kiln compartment 1 and being e.g. intended for personal access. On the other hand, by the shown embodiment the wall 11 is equipped by a lifting loading door, in which is in this case fixed at least one system vent 111, which is otherwise arranged in the area of the said wall 11. In accordance with the general idea of the invention will the role of the system vent 111 be explained in more detail as follows.

On the opposite side of the kiln compartment 1, namely on the top of the wall 12, there are fixed suitable integrated micro climate vents 1211 equipped with appropriate exhaust funnels 1210, 1220 of the aerating respectively exhausting air shafts 121, 122 as a way by which the interior of the kiln compartment is connected with the external atmosphere. With the help of the micro climate vent 1211 the air shaft 121 connects or disconnects the exterior atmosphere and the interior area 10' near the top 100 of the kiln compartment 1; analogous the air shaft 122 is connected in the same way with the help of appropriate micro climate vent 1221 to external atmosphere and the interior space 10" near the bottom 101 of the kiln compartment 1 in a certain distance with respect to the back wall 12, where is also placed a heat condensation device 2. By using the micro climate vent 1211 great advantages are obtained in cases when performing the drying program is in automatic mode.

The heating condensation device 2 is schematically shown in the Fig. 8 and consists of the following parts: a housing 20 equipped with an outlet 201 for condensate, a condensation unit 21, a heating unit 22, a compressor 23 and a throttle, which are mutually connected in appropriate circuit 26 together with

condensation unit 21 and heating unit 22 and a ventilator 25 which enables an air flow from condensation unit 21 to heating unit 22 continuing on in the same direction towards other interior areas of the kiln compartment 1. Such a heating condensation device 2 enables that warm moistured air with the help of condensation unit 21 reduces the amount of moisture in it formed as condensate flowing out trough a escape - pipe 201. The air is warmed up in the heating unit 22 for approximately 2°C with respect to temperature of the air entering the kiln volume from its circumferential area.

In the kiln compartment 1 is assembled the top of the kiln volume, partition wall with an air deflector 3 close to the heat condensation unit 2 in a certain distance from the side wall 12 which is connected with the bottom area 101 of the kiln compartment 1. The air shafts 121, 122, and heat condensation device 2 are placed between the side wall 12 and the top area 100 with the air deflector 3 placed under the top area 100 of the kiln compartment 1 in a certain distance from the top area 100 extending to the door 11 with the system shaft 111 of the kiln compartment 1. The top area 100 with air deflector 3 is positioned in relationship to top 100 and door 11 with the system shaft 111 of kiln compartment 1 in a way to close the passage 30 between the top 100, side wall 112 and the top with air deflector 3. The system shaft 111 can be led in automatic mode.

The shape and the position of the air deflector 3 placed under the top area 100 enable forming a tunnel shaped air shaft 1000, in which is placed the ventilation unit 40 comprising two properly spaced ventilators 41, 42 installed near the air shafts 121, 122 with the possibility of two more ventilators 43, 44 placed in the middle part of the kiln compartment 1 equipped also with heating elements 430, 440.

Under the top and air deflector 3 is in the space between the bottom 101 and system vent 111 and the wall respectively the loading doors 11 and the rest of

10

the kiln volume 6 do offer enough large kiln volume that loading of at least one ore more carriages with stacking units 5 is possible on which is stacked wood or other materials intended to be dried. In accordance with the principle of the invention will all details considering position 5 be explained as following.

In the drying device there is also installed at least one ventilaton unit 7 consisting of at least one ventilator 71 with the ability of angular disperson 72 of the current air flow. In position when ventilator is arranged parallel to adjacent side wall of the kiln compartment 1 is in inactive state and - vice versa - when being swung in another position it is in the active state. Ventilator has to be swung in its inactive state e.g. when the carriages 5 are moved along the kiln volume 6 for whatever the reason. Two ventilators 71', and 71" as shown in the Fig. 3 are separately arranged on appropriate supports 72', 72" each at the one side of the longitudinal side walls 13, 14 of the kiln compartment 1.

The carriage stacking unit 5 for wood as shown on Fig. 9 is equiped by wheels and foreseen for placing into the kiln volume 6. The carriage stacking unit 5 is in accordance to the invention constructed in such a way that it enables stacking the wood in a vertical position with the help of vertical distant elements 51 that also enable vertical stacking 52 with ensuring stacking through the width in specific degree. At least one stacking unit 5 is equiped by wheels 50 on Fig. 4 with the recommendation of having more stacking units. In this way it is possible to mount one on each other separate stacking units 5 equipped by wheels 50 to the required height. In this way as shematically shown on Fig. 5 and 7 is achieved stacking in vertical and horizontal direction in the required value through out the kiln volume 6 what consequently ensures good air permeability.

11

According to the invention it is most suitable to choose stacking of wood in the kiln volume 6 on the stacking units 5 in a way to achieve that dominant surfaces of wood are arranged in a vertical plane. Parts of wood of smaller width needs to be stacked in the stacking unit 5 by being put one on each other in a vertical position with ensured air gap distance between the wood by means of appropriate distance element 51'.

In accordance with the invention is moreover in the kiln compartment 1, more exactly in the area 10', a UV-radiation device 8 is mounted, which is preferably an emitter of ultra-violet and is foreseen for emitting of UV-rays to the moisture contained in the air with the intention of eliminating the possibility of development cultures like mould, fungi and other microorganism.

In the kiln compartment 1 in the area 10' there are furthermore available at least two magnets 9 in bipolar arrangement where magnetization treatment influences on all processes – chemical, physical and biological and on properties of all moisture that is present in the kiln volume 1.

In accordance with the invention the drying device on Fig. 4 and 5 enables an integrated drying process of dehumidification by condensation-convection method in a way as explained before. The wood intended to be dried is put into kiln volume 6 by opening loading lifting doors 11 on stacking units 5 on which is properly stacked wood with accessories 51, if needed also with vertical distance elements 51' and horizontal distance elements 52. A thin layer of wet substance stuck to rough surface of sawn wood is present on wood in this phase preventing further lossing of moisture content from wood. After the wood is put in the kiln volume 6 and the doors 11 closed the process of drying is started by activation of ventilators 41, 42, 43, 44, ventilation unit 40, ventilator 25 attached to the heat condensation unit and activated ventilators 71. The system vent 111 assembled in the wall respectively the door 11 is closed. The heat condensation unit 2 is activated and appropriate air

12

circulation is generated on a preset temperature value achieved by activating heating elements 430, 440 of the ventilation unit 40. When the conditions correspond to those as required, the heating elements 430, 440 are disactivated and the required heat may be supplied only with activated heat condensation device 2. With the intention of acceleration of the drying process appropriate circulation of suitable warmed up air has to be established. When moisture present on/in the wood is absorbed by the air it is lead through the heat condensation device 2 where it is eliminated with the help of condensation unit 21 as shown in the Fig. 8 and thereafter led out of the device by means of the escape pipe 201. In this phase can the kiln compartment 1 be connected with external air by means of air shafts 121 and 122. When passing trough the heat condensation device 2 the air is warmed up to a certain degree and sucked by ventilators 25 and 41, 42, 43, 44 in a circulating movement trough the tunnel shaped air shaft 1000 where it is heated up if necessary by means of appropriate heating elements 430 and 440 thereafter it passes trough the passage 30 and by the system vent 111 and air deflector 3 entering in the kiln volume 6 where it is lead by ventilators 17 depending on the configuration of the wood that is stacked on carriage stacking units 50.

The drying conditions enable an intensive transfer of moisture from wood to the circulating air. Through the air shaft 122 the air emerges from the kiln volume 6 and the kiln compartment 1 outwards to the external atmosphere. As it is known from the science, the collar air enriched with moisture has downstream tendency, in this case therefore towards the bottom 101 of the kiln compartment 1. However, due the pressure difference is simultaneously the emerged air through the air shaft with the help of micro climate vent 1211 replaced by fresh air containing less moisture through the air shaft 121.

The rest of the air available in the kiln volume 6 passes trough the heat condensation unit 2 where moisture from the air is released by the help of condensing unit 21 and partially dried and heated up by means of the heating

13

unit 22 to the desired degree emerges entering the tunnel air shaft 1000 with the help of all ventilators starts a new circulating cycle by entering into the kiln volume 6. The drying mode as described enables especially at the beginning when a lot of free water is present on the wood and in it an efficient way to dry wood without heating it up to high temperature causing possible drying defects known by drying in the past.

In order to achieve pre-defined and controlled value of air moisture with the above described drying technology in the kiln compartment 1 and the kiln volume 6, now the drying conditions have to be changed. As it is known, the wood contains capillars in cells that contain free liquid and absorbed molecules of water called moisture content which by being lowered if applying the right drying technology must be executed in the proper climate conditions depending mainly on the kind of wood and varying essentially from kind to kind, where circulating air should always be capable of reducing moisture content, constantly emerging from the drying wood.

In the above mentioned way it is possible to execute drying in a simple and surprisingly short time by the new developed drying device in kiln volume 6 without engaging accessories of any kind and restaking processes of wood and without additional heating of air. The air passes through the passage 30 near the air deflector 3 and the system vent 111 is opened as shown on Fig. 6 and 7 in consideration that in most cases additional heating of air is not needed, even functional exterminated the implementation of the new developed drying process can be executed. The micro climate vent 1211 and the air shafts 121 and 122 are by implementation of new developed drying manner in their closed position.

Therefore, according to the invention, the difference comparing to known solutions of drying processes is physical prevention of repeated circulation and mixing of dry and saturated air what would cause low efficiency. The

WO 99/23430

PCT/SI98/00008

14

activated ventilators 41, 42, 43, 44 of the venting unit 40, ventilator 25 of the heat condensation device 2, and ventilators 71 generate appropriate air circulation. The external air led into the kiln compartment 1 and consequently into the kiln volume 6 passes through the system vent 111, which is opened, and is thereafter led through the kiln volume 6 and through a self-adjustable vent 31 and after that through the heat condensation device 2 containing heating unit 22 is mostly or even permanently functionally exterminated but with the help of ventilator 25 is led through the tunnel-shaped air shaft 1000 to the air passage 30. When the system vent 111 is in the opened position the air emerging from the air passage 30 cannot reenter the kiln volume 6 but is exhausted from the kiln compartment 1 to the external atmosphere. In this way it is achieved that only a dry fresh air has the ability to get in contact with the drying wood. Those skilled in the art should understand that the intaken fresh air would have to be treated in certain ways in cases of extreme climate conditions what can be done with the help for this meant accessories what does not influence on the principle of the invention.

PATENT CLAIMS

1. A drying device, which is created on the basis of many ventilation air systems arranged in a kiln compartment (1) and equipped by a heat condensation device (2) comprising a condensation unit (21) and a heating unit (22), and with at least one ventilator (25), with a kiln volume (6) as well as with at least one loading door (131) in a kiln compartment (1) where wood or other material for drying is placed with the help of carriage staking units (5) with gradual absorption of moisture content in the wood to the circulating air available in the said kiln compartment (1) and particularly in the said kiln volume (6), characterized by that at least one wall (11), which may also be arranged as a door, is equipped by a system vent (111), which in sense of functional leading of air flow for performing and monitoring the kind of drying mode in combination with an air deflector (3) placed above the kiln volume (6) in the kiln compartment (1) with the heat condensation device (2) ending in a certain distance from the another side wall (12) of the kiln compartment (1) close to the bottom (101) of the kiln compartment (1) to which also extends the said air deflector (3) close to the heat condensation device (2) equipped at least with one self-adjusting vent (31) and air deflector (3) extending over the kiln volume (6) to the top (101) of the kiln compartment (1) in a direction towards the system vent (111) and the air passage (30) between the air deflector (3) and the said system vent (111) assembled in the wall respectively the door (11) of the kiln compartment (1) formed tunnel shaped air shaft (1000) in which is placed appropriate ventilation assembly (40).
2. Drying device according to Claim 1, characterized in that both aerating and exhausting shafts (121, 122) are equipped by one and the same micro climate vent (1211) arranged adjacent to the wall (12) of the kiln compartment (1), next to which near to the air deflector (3) a heat condensation device (2) is

16

arranged, so that from the kiln compartment (1) one air shaft (121) extends to the exterior atmosphere under the top (100) of the kiln compartment (1) and the second air shaft (122) which extends to the exterior above the bottom (101) of the kiln compartment (1).

3. Drying device according to Claims 1 and 2, characterized in that in the kiln volume (6) is placed at least one additional ventilation unit (7) comprising at least one ventilator (71) placed on an adjustable support (72) enabling angular dispersion of air flow with the ability of putting it in off mode if placed parallel to the side wall or in position on mode if placed unparallel.

4. Drying device according to Claim 1, characterized in that the system vent (111) is arranged the wall respectively the door (11) of the kiln compartment (1) in such a manner that in its closed position is enabled internal circulation of the air flow from the tunnel-shaped air shaft (1000) in the area between the top (100) of the kiln compartment (1) and the air deflector (3) passing through the air passage (30) between the air deflector (3) and the wall respectively the door (11) into the kiln volume (6) in a direction towards the self adjustable vent (31) and under the air deflector (3) towards the heat condensation unit (2), since in the case when the system vent (111) is opened the air flow is passing from the tunnel shaped air shaft (1000) through at least two gaps formed by opening the system vent (111) the air is blown out of kiln compartment (1) in open space on the upper side through at least one gap and simultaneously the fresh air is sucked from outside directly into the kiln volume (6) through at least one lower gap.

5. Drying device according to Claim 1, characterized in that at least some of ventilators (41, 42, 43, 44), which are arranged in the tunnel-shaped air shaft (1000) available between the air deflector (3) and the top (100) of the kiln compartment (1), are equipped by appropriate heating units (430, 440) provided for complementary heating the air in the tunnel shaped air shaft (1000).

6. Drying device according to Claim 1, characterized in that the carriage staking units (5) intended for displacement of drying material, particularly wood, is equipped not only with vertical distance elements (51), but also with horizontal distance elements (52).
7. Drying device according to Claim 6, characterized in that at least some of the carriage staking units (5) are equipped by wheels (50) ensuring their mobility.
8. Drying device according to Claim 6 and/or 7, characterized in that the carriage staking units (5) can be put one on each other by means of the vertical distance elements (51).
9. Drying device according to Claim 1, characterized in that the heat condensation unit (2) comprises at least a condensation unit (21) and a heating unit (22).
10. Drying device according to Claim 9, characterized in that the heat condensation device (2) in its housing (20), which is equipped with an escape pipe (201) for leading out the condensate, near to the condensation unit (21), the heating unit (22), a the compresor (23) and a throttle (24), which are bound to appropriate circuit, also comprises a ventilator (25).
11. Drying device according to Claim 1, characterized in that the kiln compartment (1) is constructed on the base of a standard container fulfilling dimensional standards for international container transports.
12. Drying device according to Claim 1, characterized in that the vent (31) of the air deflector (3) is self-adjustable.

18

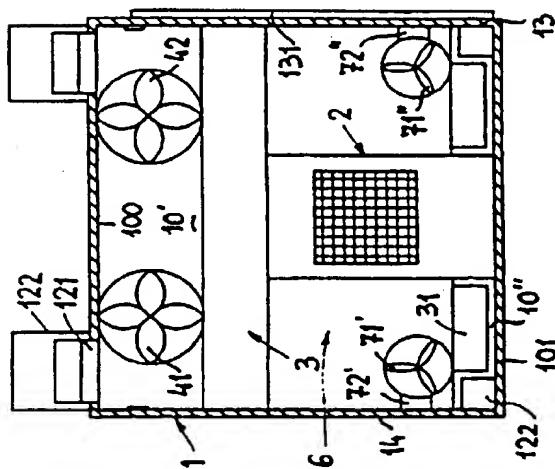
13. Drying device according to Claim 1, characterized in that in the interior of the kiln compartment (1) a radiation device (8) is placed close to the venting and exhausting shafts (121,122).
14. Drying device according to Claim 13, characterized in that the radiation device (8) is preferably an emitter of ultra-violet rays.
15. Drying device according to Claim 1, characterized in at least two magnets (9) are arranged in the kiln compartment (1).
16. Drying device according to Claim 15, characterized in that at least two permanent-magnets (9) are arranged in the interior of the kiln compartment (1).
17. Drying device according to Claim 16, characterized in that in the interior of the kiln compartment (1) a bipolar magnetic field is available by means of at least two permanent-magnets are arranged adjacent to the exhausting and aerating shafts (121, 122) and the air deflector (3).
18. Drying device according to Claim 6, characterized in that the distance between neighbouring vertical distant elements (51) - observed in a horizontal direction - are always shorter than side vertical supports (52).
19. Drying device according to Claim 6 and 18, characterized in that the staking unit (5) aside vertikal distance elements (51) predicted use of horizontal distance elements (51') for ensuring proper air gap respectively certain distance between wooden elements put one on each other in a vertical direction between vertical distance elements (51).
20. Drying device according to Claims 1 and 2, characterized in considering microclimate vent (1211) functioning in combination with air shafts (121,

WO 99/23430

PCT/SI98/00008

19

122) which is in case of increased moisture value activated on the top of kiln compartment (1) and is connected with the kiln volume (6) through the air shaft (122), where air is blown out, but by the help of air shaft (121) in case of pressure differences fresh outside air is sucked into the area (10'), but when the microclimate vent (1211) is unactivated is the drying process isolated from external atmosphere air and internal air circulation is generated in the kiln compartment (1).



1/4

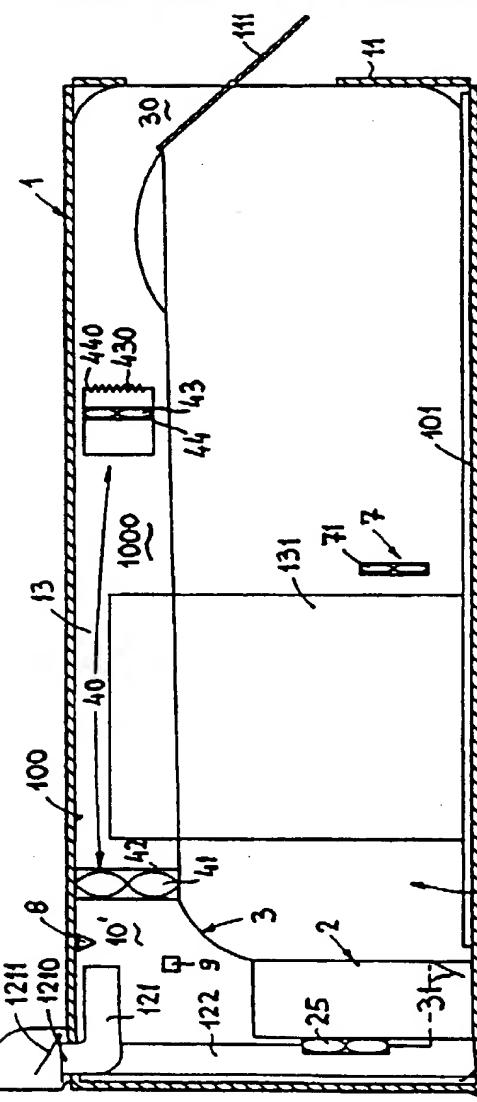
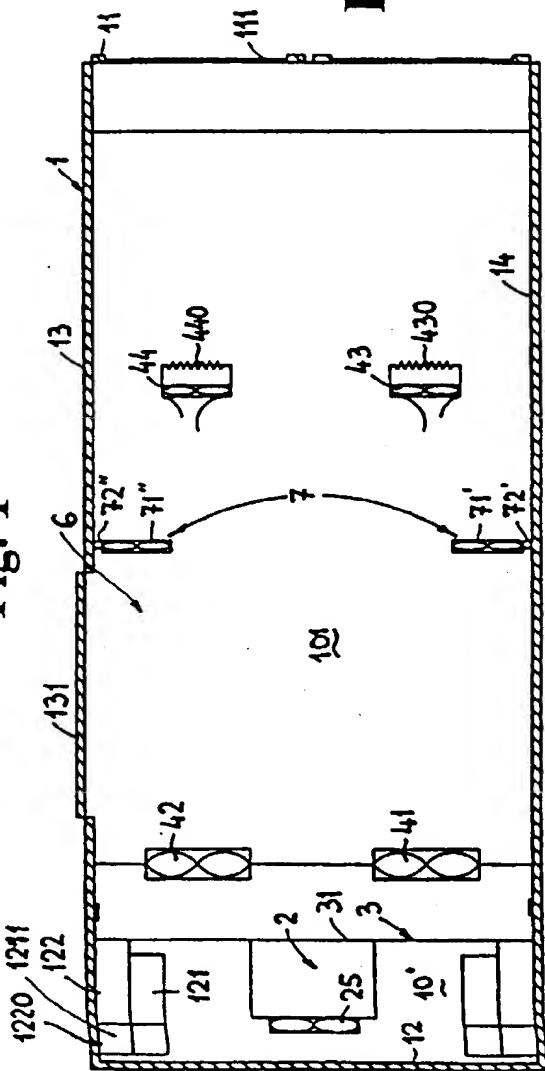


Fig. 2



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Fig. 4

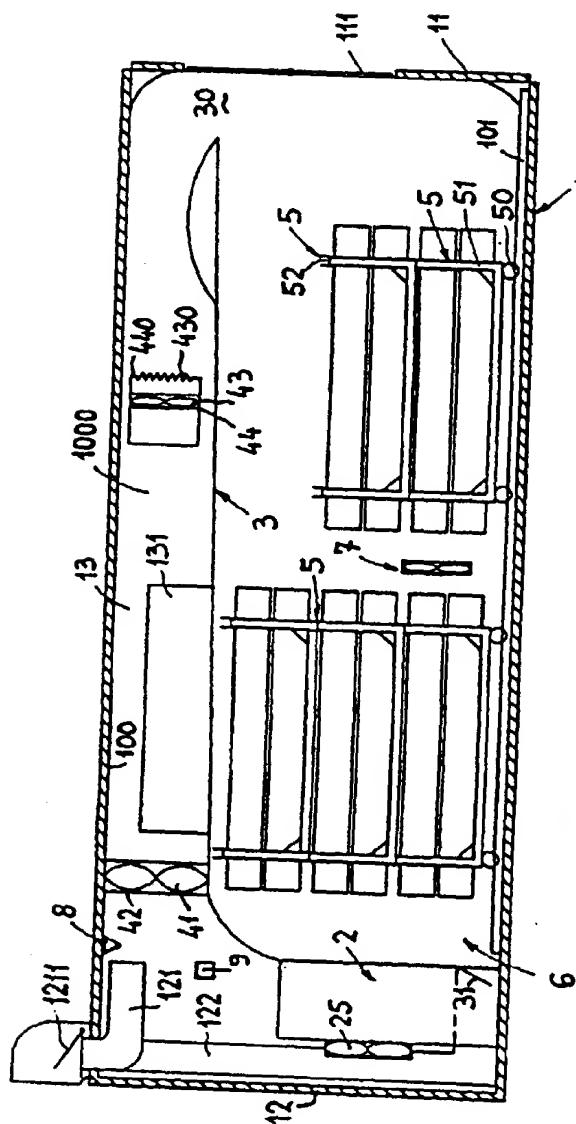
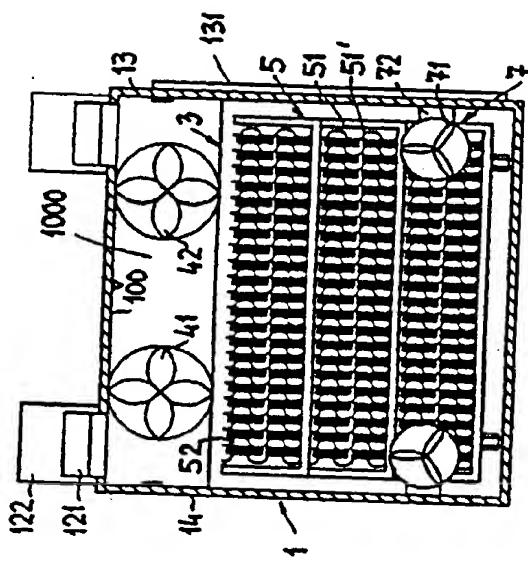


Fig. 5



3/4

Fig. 6

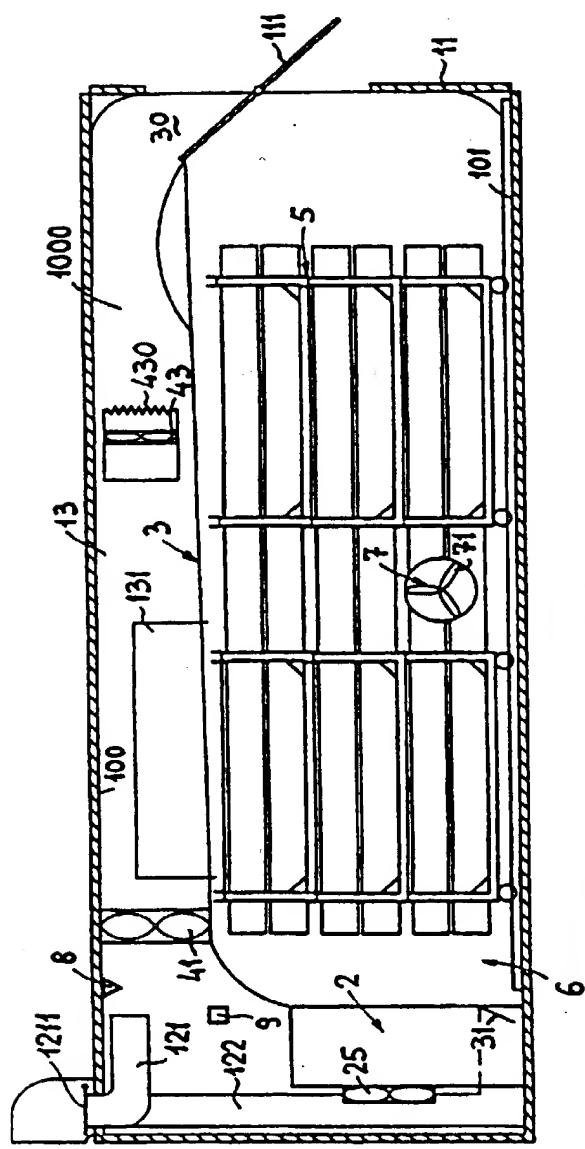


Fig. 7

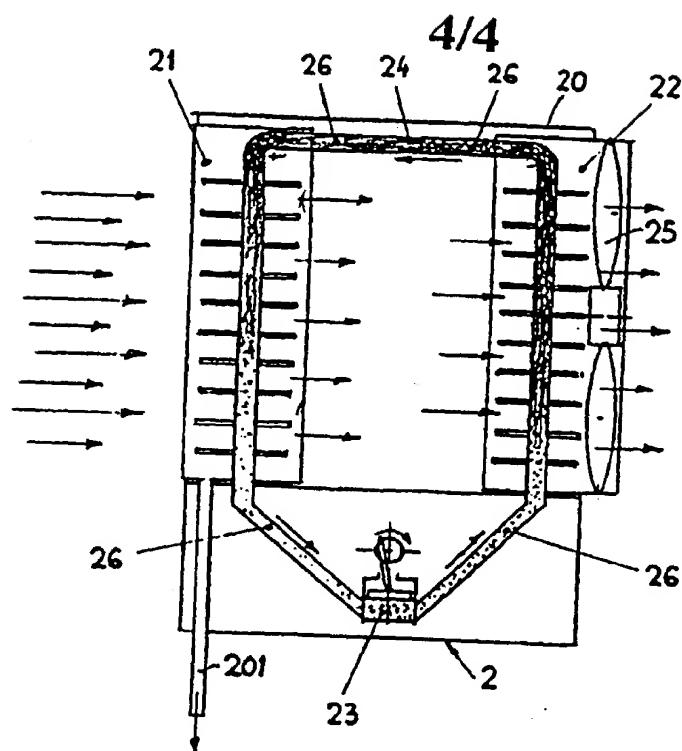


Fig. 8

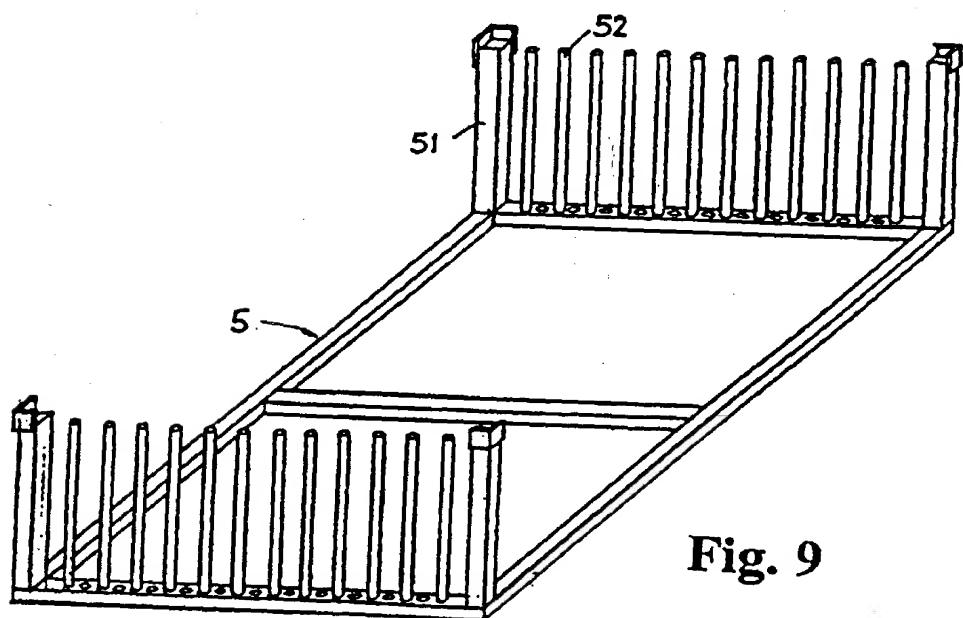
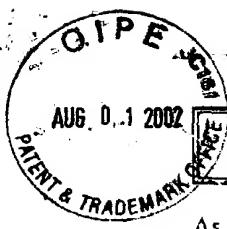


Fig. 9



AUG. 01 2002

UNITED STATES

PATENT APPLICATION

DECLARATION AND POWER OF ATTORNEY - ORIGINAL APPLICATION

ATTORNEY'S DOCKET NO.

204,509

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name:

I verily believe I am the original, first and sole Inventor (if only one name is listed below) or a joint inventor (if plural inventors are named below) of the invention entitled

(1) TITLE OF
INVENTION

(1) A DRYING DEVICE

RECEIVED

AUG 19 2002

Technology Center 2600

(2) CHECK
APPROPRIATE
BOX

the specification of which

(2) is attached hereto.(X) was filed on March 30, 1998 as Application No. PCT/SI98/00008
and was amended on _____ (If applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge my duty to disclose information of which I am aware which is material to the patentability of this application under 37 CFR 1.56(a): the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months prior to this application; and as to applications for patents or inventor's certificate on the invention filed in any country foreign to the United States prior to this application by me or my legal representatives or assigns.

(3) CHECK
APPROPRIATE
BOX(3) no such applications have been filed, or
 such applications have been filed as follows:

EARLIEST FOREIGN APPLICATION(S), IF ANY, FILED WITHIN 12 MONTHS PRIOR TO THIS APPLICATION				
Country	Application Number	Date of Filing (day, month, year)	Date of Issue (day, month, year)	Priority Claimed Under 35 USC 119
(4) SLOVENIA	P-9700284	04 Nov. 1997		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
SLOVENIA	P-9800094	27 March 1998		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
ALL FOREIGN APPLICATIONS, IF ANY, FILED MORE THAN 12 MONTHS PRIOR TO THIS APPLICATION				

(4) COMPLETE
DATA INDICATED
IF APPLICABLE

I hereby claim the benefit under Title 35, United States Code § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112. I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

(5) COMPLETE
DATA INDICATED
IF APPLICABLE

(5) _____ (Application Ser. No.)	(Filing date)	(Status: patented, pending, abandoned)
(5) _____ (Application Ser. No.)	(Filing date)	(Status: patented, pending, abandoned)

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ABELMAN FRAYNE

003/003



Power of Attorney: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both under Section 101 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

(b) DETAILS
REQUIRED
FOR EACH
INVENTOR

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